

This listing of claims replaces all prior versions and listings of the claims in the application.

In the Claims

1-3. (cancelled)

4. (previously presented) The method of Claim 10 wherein said trench is formed by anisotropic etching.

5. (currently amended) The method of Claim 10 wherein said widened trench is widened by isotropic etching using a chemistry including an HNO_3/HF mixture.

6. (currently amended) The method of Claim 10 wherein said widened trench is widened by anisotropic etching using a chemistry selected from the group consisting of wet alkaline chemistry and NH_4OH .

7. (previously presented) The method of Claim 10 wherein said trench is deepened by anisotropic etching.

8-9. (canceled)

10. (currently amended) A method of providing a trench capacitor on a semiconductor substrate, comprising:

forming a pad stack including a first material on a semiconductor substrate;

forming a hard mask including a second material over said pad stack, wherein said first material is etch distinguishable from said second material;

patterning said hard mask and said pad stack to form an opening aligned openings in said hard mask and said pad stack extending from a top surface of said hard mask to a top surface of said semiconductor substrate;

vertically etching said semiconductor substrate through said opening aligned openings to form a trench;

horizontally widening sidewalls of said trench by a first etch process to form a widened trench having widened sidewalls extending from said top surface of said semiconductor substrate;

widening sidewalls of said opening in said pad stack by a second etch process having etch selectivity to said second material to form a widened opening in said pad stack relative to said opening in said hard mask such that said hard mask overhangs said widened sidewalls of said widened opening in said pad stack and overhangs said widened sidewalls of said widened trench;

forming a sacrificial collar on said widened sidewalls of said widened trench;

vertically deepening said trench to create a lower portion extending below said sacrificial collar; and

forming a capacitor in said lower portion.

11. (original) The method of Claim 10 wherein said pad stack comprises a pad nitride layer overlying a pad stop layer including an oxide.

12. (currently amended) The method of Claim 10 wherein said second material ~~hard mask comprises~~ is an oxide layer selected from the group consisting of a tetraethylorthosilicate (TEOS) deposited oxide layer and a borosilicate glass (BSG) deposited oxide layer.

13. (original) The method of Claim 10 wherein said sacrificial collar comprises a layer of nitride.

14. (currently amended) The method of Claim 13 wherein said sacrificial collar further comprises a layer of oxide below said layer of nitride, said layer of oxide contacting said widened sidewalls of said widened ~~trench under said layer of nitride.~~

15. (original) The method of Claim 10 further comprising widening said lower portion by an isotropic etch to achieve a bottle-shaped structure prior to forming said capacitor.

16-20. (canceled)